A LEAF MIMICKING FISH.[1]

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Heckel, in Johann Natterer's "Neue Flussfische Brasilien's nach den Beobachtungen und Mittheilungen des Entdeckers,"[2] described a small fish 3.5 inches long from a forest pool along the Rio Negro. He named it *Monocirrhus polyacanthus* and stated that at Marabitanas it was called *pirá-cáa* which means leaf-fish. Marabitanas is less than one degree north of the equator near the fiftieth degree of west latitude, in other words about sixty miles south of the southern end of the Rio Cassiquiare. No other specimens have been recorded. Günther placed it with *Polycentrus* to constitute the family Polycentridæ. The leaf-like appearance evidently impressed the Indians about Marabitanas who were acquainted with it and had a name for it.

During the Centennial Expedition of Indiana University, Dr. Allen secured three specimens of the same, or of a similar species from a brook near the Rio Itaya at Iquitos on the Peruvian Amazon.

The junior author reports that this fish was collected on September 19, 1920, while a guest of Don Antonio Layet at his hacienda, about six kilometers up the Rio Itaya from Iquitos. It was found in a small, sluggish brook which flows over very flat second bottom land, seldom inundated, and in the midst of dense forest.

There had not been much recent local rain, and there was only a slightly perceptible trickle of current at the riffles. Most of the brook was now reduced to quiet pools ten to fifteen feet across, densely overhung by vegetation, and shaded except for an hour or two at mid-day. The water was clear and of a slightly brown color, the bottom brushy, and matted with fallen leaves.

"Sr. Layet's servants had just introduced poison for me at the riffles, allowing it to flow slowly into the pools. Others with their long knives had made paths by which the low bank could

[1] Contribution from the Zoölogical Laboratory of Indiana University, No. 183.

[2] Ann. Wien Mus., 1840, II., p. 439.

be followed, The poison used was the milky sap washed from the pounded roots of *cube* (or *barbasco*), a plant cultivated as a fish poison and insecticide wash for cattle.

"I was beginning to grow impatient at the slowness of the poison, and to wonder if our long wait was going to be useless. I had observed several different species of fishes but they did not seem to be yielding to the usual respiratory difficulties following *cube*-poisoning, nor even to be trying to escape past the seines which we had stretched across the brook above and below.

"In order to know if there was sufficient current to carry the poison to every part of the pool, I began tossing broken twigs on the water to observe their course with the current. One such twig had reached a standstill, when directly beneath it I saw what was apparently a dead leaf being wafted past the twig. I couldn't understand why the twig was not moving too. At about that moment the leaf moved out into a path of sunlight, and toward the surface. There the resemblance to a fish became apparent, especially to one in search of the same. Its behavior, too, was like that of a poisoned fish struggling for oxygen."

The outline of the fish is similar to that of an asymmetrical leaf. The erected spinous dorsal and anal with their serrated character are not unlike the toothed edge of a leaf. The mimicry in color and markings is very close, the photograph and drawing of the dead specimens scarcely doing it justice. The lateral band has a position like that of a midrib of an asymmetric leaf. Like a midrib it fades away before reaching the distal margin. A petiole is not lacking, for the sharp, elongated snout and the protractile barbel carry out the resemblance.

While this fish may fall short of the perfection in mimicry exhibited by Kallima, it does take due account of the fact that few perfect leaves exsist, especially by the time they have reached the water. The transparent dorsal and soft anal between the spinous fins and caudal peduncle resemble breaks in the margin of a leaf. Futhermore the faded and discolored portions of many leaves, due to fungi, have their counterpart in the more ashy triangular area in the forward half of the fish.

The mimicry of *M. mimophyllus* has a physiological side. When swimming it moves in a gliding manner (like a seahorse)

that resembles a drifting leaf. This movement is due chiefly to the rapid beating of the small transparent soft dorsal and soft anal. These fins are set within the outline of the body, their bases being transverse to the body length. They have the direct forward push of the screws of a ship. Being hyaline their motion does not attract attention.

Several other species of fishes in the forest pools have the color of dead leaves. The others were seen before yielding to the poison, while *M. mimophyllus*, with a much more complete mimicry, was not.

A technical diagnosis of the species follows.

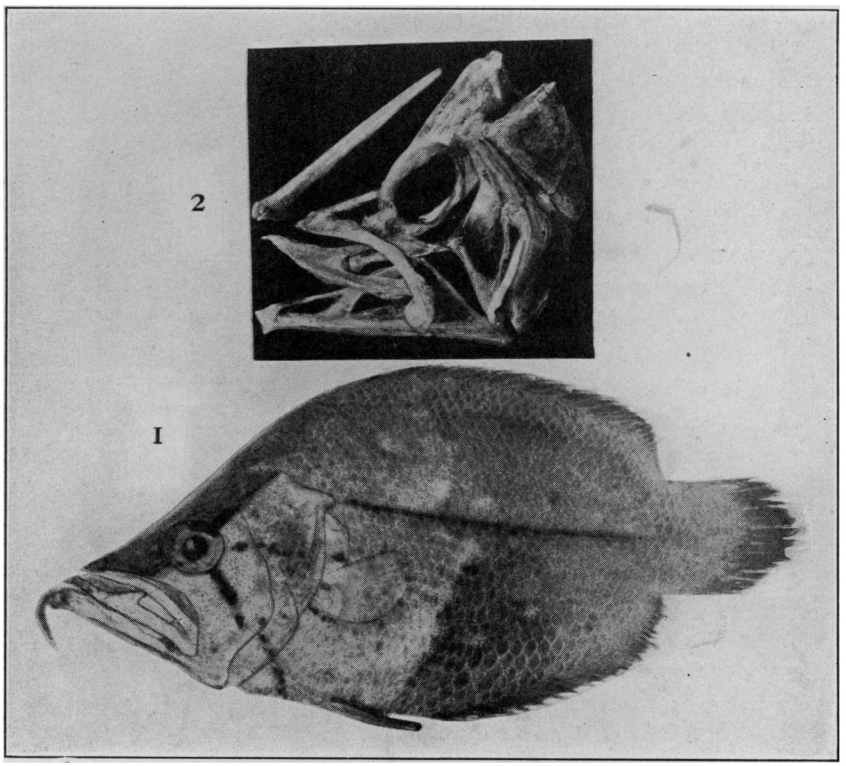

FIG. 1. Photograph of a specimen 61 mm. over all.

FIG. 2. Photograph of the skeleton of the head. The premaxillary spine is broken off from the rest of the bone, and the posterior end of the premaxillary has slipped upward a little away from its original position.

MONOCIRRHUS MIMOPHYLLUS Eigenmann & Allen spec. nov.

15715, I., 3, 44, 47, and 51 mm. long to base of caudal (65 mm. over all). Brooks near the Rio Itaya, Iquitos. Collected by Dr. W. R. Allen.

Evidently closely allied to *M. polyacanthus* Heckel, if distinct. In *M. polyacanthus* the caudal is said to be emarginate, the lateral band is said to run through the lower half of the tail, and the edge of the dorsal, anal, and tip of the ventrals are said to be blackish, the end of the caudal white.

Head 2.5; depth 1.92; D. XVI or XVII, 13; A. XII or XIII, 12 to 14.

Greatly compressed, the snout very sharp, the chin projecting, with a goatee barbel; the two rami of the mandible in contact below, equal in length to the head behind the anterior nares; maxillaries equal to snout and eye; premaxillaries greatly protractile; eye 1.5 in snout, 4 in the head, about .8 in the interorbital; opercular spine on a line between the upper margin of the orbit and the upper margin of the caudal peduncle. Profile between snout and occiput concave; gill-membranes somewhat united, entirely free from the isthmus, entirely hidden by the rami of the mandible.

Tongue very long and slender, rod-like, the free portion about as long as the eye, its tip soft, curved up and slightly cupped; premaxillary spine extending far beyond the eye, equal to the length of the mandible; mandible with one, in part two series of minute, recurved teeth; premaxillary with a single series of teeth on the sides, a triangular patch of teeth at the tip; no teeth on roof of mouth.

Pectoral broad, its length about 3 in the head, soft-rayed; distance between tip of the snout and origin of the dorsal a little more or a little less than 2 in the length without caudal; base of the spinous dorsal 2 in the length; base of soft dorsal about one-fifth of the length of the spinous dorsal; caudal *rounded*, equal to snout and eye or a little shorter; origin of anal and third dorsal spine equidistant from tip of snout; base of spinous portion of the anal about three in the length; base of soft part of anal a trifle longer than base of soft dorsal; ventrals reaching origin of anal, their inner ray adnate. First ray stout and spinous. Cheeks, opercle, and top of head to tip of snout scaled; preorbital

the only portion of the head naked. Scales of sides regularly imbricate, without lateral line pores; dorsal and anal partially depressible into a scaly sheath, the spines alternating when depressed. The scales of the sides roughened on half their exposed part, margined with very fine hyaline spinules.

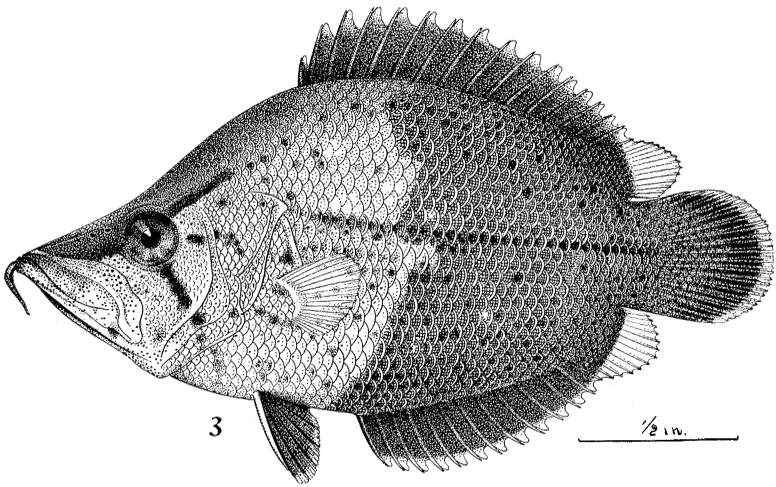

FIG. 3. Drawing of another specimen by W. S. Atkinson.

Four gill arches, lower arch of the first one with eleven rakers, the first a spinulous patch without projection, graduated to the last one which is about two thirds as long as the eye; all of them with numerous small spines; only two spinulous cushions on the upper arch; pharyngeal teeth similar to those on the gill-rakers.

Pectorals, soft dorsal, soft anal, margins of spinous dorsal, spinous anal and caudal and to a less extent of the ventrals hyaline; the hyaline of all but the soft dorsal, soft anal and pectoral bordered by black; a dark line from above the upper angle of the gill opening through the middle of the eye to the maxillary, a similar line from the eye through the cheeks crossing the breast half way between the ventrals and the gill opening, another one extending straight back from the eye; a similar dark line extending from the point of the opercle to the middle of the caudal peduncle; area from the middle of the ventrals up to the dorsal and then forward below the line through the eye to the mandible several shades lighter than the back or the area behind this line. Slightly coppery color in living fish, this shade lost in alcohol.